

Trauma Rounds

Chief Discussant

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Management of Ruptured Aneurysms of the Abdominal Aorta

FRAZIER HUBBARD:* The patient is a 70-year-old white man who was admitted to the emergency room of a major hospital on January 6, 1974, with chief complaint of steady cramping pain in the left lower quadrant of the abdomen. On examination he appeared to be relatively normal, with no specific abdominal findings. Blood cell count and urinalysis were within normal limits. The patient was given analgesia and sent home to return if the pain persisted.

Next day he returned with exacerbation of the pain. During routine examination he became hypotensive and temporarily unresponsive. Intravenous lines were placed and a pulsating abdominal mass was felt. The patient was taken immediately to the operating room and it was found that an abdominal aortic aneurysm had ruptured. Besides a liter of free blood in the peritoneal cavity there was a large retroperitoneal hematoma. The suprarenal aorta was cross-clamped to facilitate control of the bleeding and a dacron aortoiliac bifurcation replacement graft was inserted. The patient required 12 units of whole blood during the procedure.

In the postoperative period the blood pressure was normal but the urinary output progressively fell and the blood creatinine rose despite the ad-

ministration of fluids, mannitol and furosemide (Lasix®). The patient was transferred to San Francisco General Hospital for renal dialysis, presumed necessary because of ischemic renal damage from shock and aortic cross-clamping.

BARRY GARDINER, M.D.:† We are fortunate to have, as our guest discussant today, Dr. Edwin J. Wylie, professor of surgery and chief of vascular surgery at the University of California School of Medicine. Dr. Wylie, will you comment on the manifestations of the ruptured aneurysm and describe what you consider the key factors in diagnosis?

EDWIN J. WYLIE, MD:‡ The nature of the presentation of the ruptured aneurysm determines the appropriate reaction. There are a number of different initial manifestations, including three rare types of rupture. The three unusual manifestations consist of: (1) rupture into the adjacent vena cava with formation of an arterial-venous fistula, (2) rupture into the duodenum with massive gastrointestinal hemorrhage, and (3) dissection into a plane behind the psoas muscle with back pain and the presentation of an inguinal mass which may be confused with a strangulated hernia.

Rupture into the vena cava is an extremely rare phenomenon. It is described in the literature,

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but I myself have only seen two such cases. The patient with rupture into the vena cava goes into acute cardiac failure and presents with a high venous pressure and acute respiratory distress. He usually arrives by ambulance, with everybody cognizant of the cardiac nature of the emergency. The key to diagnosis is the presence of a palpable, pulsatile mass and a loud "machinery" bruit on auscultation. Treatment requires immediate exploration and control of the aneurysm. All the medical therapy in the world will not control the cardiac failure.

The manifestation of duodenal rupture consists of massive gastrointestinal hemorrhage which may present as hematemesis or melena. This is also a rare complication of a primary aneurysm. The diagnosis can be made only at operation, but it can be suspected if a patient with a massive gastrointestinal hemorrhage has a pulsatile mass palpable in the epigastrium. The catastrophic nature of the hemorrhage usually dictates immediate operation.

The third type consists of a small aortic blister rupturing posteriorly and dissecting paravertebrally along the psoas plane. It often presents as a mass at the inguinal ligament, which may be tender. The abdominal pain may be mild to moderate, not as severe as it was in the patient we are discussing here. The patient is usually apprehensive. On physical examination, the psoas sign is present, a leg is flexed and the patient very reluctant to extend it.

The most common rupture is of the type seen in the present case. The standard manifestation consists of sudden abdominal pain, often associated with back pain. The rupture can be in the wall of the aorta itself, or it may be in adjacent tissue around the aorta, or into the retroperitoneal area or into the free peritoneal cavity (Figure 1). The first three routes of rupture ordinarily follow

one another in order, and the first manifestation is usually a sudden drop in blood pressure. Tissue pressure builds up and contains the rupture as the systemic pressure falls concomitantly. The patient may have an initial episode of faintness from loss of blood, sometimes just several hundred milliliters. Then the pain subsides, the vital signs return and the patient feels better. This is a perilous trap, for there then may be a secondary rupture into the free peritoneal cavity with death following immediately. Operation, therefore, is not a matter to be delayed. Any patient with suspected impending rupture should be operated upon as soon as the abdomen can be prepared and anesthesia induced. Taken together acute abdominal pain and a pulsatile mass are indication for immediate laparotomy.

The other criterion for operation is the presence of shock. For all practical purposes, shock and the presence of a palpating, pulsating epigastric mass mean rupturing aneurysm until proven otherwise. Generally speaking, patients with rupturing aneurysms can be divided into two types, those with and those without shock. The course of the two is entirely different. The mortality rate for those arriving in shock is 75 percent; for those arriving not in shock, 25 percent. The overall mortality rate is about 50 percent. This is the national average and is essentially everybody's experience.

One should not wait until blood is cross-matched. Type-specific blood should be sent for and held in the operating room. If the patient's condition suddenly deteriorates, the blood can be given. Since many of these patients are intensely vasoconstricted, one must be on the look-out for a precipitous fall in blood pressure as the induction of anesthesia releases the constriction. If the patient's condition deteriorates during induction, don't wait for full anesthesia and don't wait for

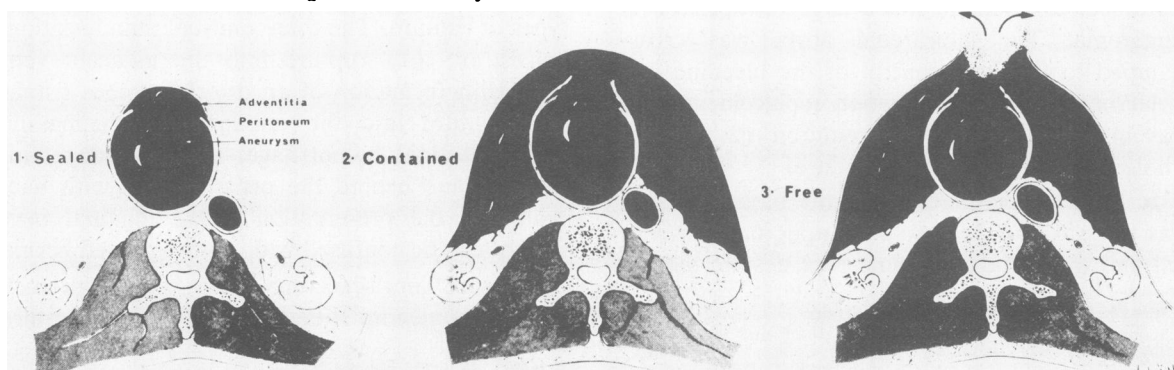


Figure 1.—Types of abdominal aortic aneurysm rupture

the razor to shave the abdomen. Proceed immediately with the incision and obtain control. The most important thing you can do for the patient is to stop the source of bleeding and save the transfused blood until you have control of the bleeding point.

Occasionally, the patient has an inflammatory aneurysm. The pathogenesis of this lesion is not known, but the wall of the artery is edematous, almost cartilaginous in nature, and is very thick. The lesion may be associated with sudden, severe abdominal pain, but rarely is it associated with acute rupture. Even so, since inflammatory aneurysms cannot be diagnosed in advance, it is better to err on the side of immediate operation rather than to defer operation and overlook the possibility of free rupture.

DR. GARDINER: *Dr. Wylie, how do you obtain control of the aorta when you open such an abdomen?*

DR. WYLIE: This is the critical part. When the abdomen is opened and there is a bulging, retroperitoneal hematoma with no free blood inside the abdomen and the blood pressure is stabilized at the head of the table, the dissection should be initiated distally and control of the iliac vessels obtained. This permits complete control to be developed rapidly once the proximal dissection is started and the aneurysm entered. All the anatomic details have been set out and the least blood loss will develop, as there will be no back bleeding with the distal control obtained, and the graft can be put in place much more rapidly with the distal dissection already done.

Repair of the inferior mesenteric artery should be deferred until it can be reached inside the aneurysm. In these large aneurysms with a peri-aortic hematoma, the only place you can get ready access to the inferior mesenteric artery from outside of the lesion is far distal on the artery, and that might compromise collateral flow. For this reason, it is better to wait until the aneurysmal sac is opened and the vessel can be controlled from within.

If the patient is in shock when the abdomen is opened or there is free intraperitoneal bleeding, you must first go for the proximal portion of the aorta. The hematoma often will have done much of the dissection for you, as it will encircle the upper aorta and displace the other anatomical structure away from the aorta. If you go into the

hematoma and reach directly for the neck of the aneurysm, you can usually pass your two fingers down on each side of the aorta and apply the crossclamps. The aorta does not need to be mobilized completely proximally as would be done in an elective procedure. There is one big point of risk, and that is the renal vein which runs across the upper end of the neck of the aorta. I have seen cases in which more blood is lost during aneurysmectomy from damage to this vessel than from anything else. If the renal vein is in the way or is inadvertently torn, I would have no reluctance to clamp it and ligate it. Collateral flow from the left renal vein is adequate to preserve the kidney. This facilitates dissection and may be of value even in elective aneurysmal operations.

If for some reason it is not possible to get at the neck of the aneurysm and the patient is bleeding, the best alternative is to open the proximal portion of the aneurysm immediately and put your thumb in the proximal aorta. Ordinarily, the neck of an aneurysm fits snugly around the base of the interphalangeal joint and good control can be obtained. The neck of the aneurysm can then be mobilized. If this becomes difficult, I consider using something like a Foley catheter, which can be inserted up alongside the thumb and into the upper abdominal aorta. Inflating the balloon then controls the bleeding. An assistant has to hold the balloon to keep it from being displaced downward, but anastomosis of the graft of the aorta can be carried out with the balloon in place. The catheter, of course, should be passed through the graft before it is inserted into the aorta.

Another alternative is to expose the aorta at the level of the celiac axis by coming down through the gastrohepatic ligament to expose the aorta just as it comes through the diaphragm. A vascular clamp placed here is effective in occluding the circulation. Apparently that was done in this case herein described. I have not seen any problems with ischemia because of interruption of blood supply to the cord, and I would not hesitate to clamp the aorta here as long as necessary.

Another way to control the aorta—I haven't had occasion to use this for a long time—is to prop the patient in a partial lateral position with sandbags and open the left side of chest and cross-clamp the descending thoracic aorta. In old patients with aneurysms, this adds another insult and should be avoided if possible.

A PHYSICIAN: *Do you have any arbitrary rule about the length of time you can crossclamp the suprarenal aorta?*

DR. WYLIE: I believe you can crossclamp the aorta for thirty or forty minutes, and perhaps even longer than that if there is underlying renal vascular stenosis. One of the problems is that the pre-existing shock may produce damage, and I believe that the suprarenal crossclamp alone was not the factor responsible for renal failure in the present case. One of the other problems that produces renal failure is that the very process that produces degeneration of the aorta produces degenerative atheromatous material in the aorta above the renal arteries. Compression of the artery may fragment this atheromatous material, which then can become emboli in the renal arteries. I believe that this factor was responsible for renal failure in at least two cases that I have seen.

A PHYSICIAN: *Does clamping the infrarenal aorta have any effect on the kidney?*

DR. WYLIE: Dr. Sam Powers, many years ago, after collecting information from all the community hospitals in the Albany area, wrote a paper saying that clamping the infrarenal aorta could cause renal failure. I believe a more significant factor is "declamping shock." The release of the occluding clamp after placement of the graft results in a period of hypotension which further aggravates shock. Certainly, if at the time of release of the occluding clamp the patient is behind in blood replacement, the hypotension can be profound and prolonged. For this reason, every effort should be made to restore the blood volume to normal or above normal just before release of the clamp. Another way is to release the clamp slowly. The clamp can be taken off and the graft compressed digitally, and then you can open up the circulation to one leg at a time or one hypergastric artery and then one external iliac at a time over a period of ten or fifteen minutes.

A PHYSICIAN: *What type of graft do you use, and does your technique vary between elective and emergency cases?*

DR. WYLIE: The only variation of my technique is the upper anastomosis. I always use a knitted, dacron graft. Usually in emergency I do not transect the aorta completely or mobilize it com-

pletely and the aneurysm is in continuity with the proximal aorta. Usually in the case of ruptured aneurysm, I only cut across the arteries two-thirds of the circumference of the aorta proximal to the aneurysm. I then cut the posterior intima circumferentially and use this groove as a guideline for the posterior suture line which is developed within the aorta.

A PHYSICIAN: *How do you cover the graft after completion of placement and restoration of flow?*

DR. WYLIE: I practically never take the aneurysm out. I strip out the lining of the aneurysm and use the remaining portion of the wall to close over the dacron graft. At this point of stripping, the lumbar arteries and the middle sacral artery have to be oversewn. The orifice of the inferior mesenteric artery is oversewn at the same time from within the aorta. I cut off all but 4 to 5 centimeters of the aortic portion of the graft so that bifurcation comes just below the site of anastomosis. It is then possible to take the left hand wall of the aneurysm and suture this between the two legs of the graft, and the right wall of the aneurysm is overlapped across the right limb of the graft and over the left side of the graft. If this is sutured down tightly, good hemostasis is obtained and the graft is prevented from coming in intimate contact with the duodenum.

One of the common complications of operations of this type is postoperative bleeding, so I spend considerable time tidying up the retroperitoneum and making sure of hemostasis. This cuts this complication to a very low level.

DR. GARDINER: *Are there any other complications that we should consider in the management of these patients or in aneurysmal operations?*

DR. WYLIE: Renal failure is the complication that is unique to operation on a ruptured aneurysm. Cardiac failure can, of course, occur after an episode of shock and blood loss. Many of the patients have cardiac disease and may not be in optimal condition for such operations. They can have an acute myocardial infarct as a complication of the operation. I have not been particularly aware of thrombotic complications although many studies have been done which suggest that the blood of these patients is hypercoagulable. Complications of distal arterial thrombosis are relatively rare and in my experience so are thromboembolic pulmonary complications. I think it is very im-

portant to administer heparin to these patients. I give them 3,500 units of heparin before cross-clamping the aorta, then an additional 2,000 units every half hour during crossclamping, although usually only one dose of heparin is indicated.

A PHYSICIAN: *Do you reverse the heparin with protamine?*

DR. WYLIE: That usually isn't necessary. I prefer to let the heparin wear off. When it is given in the dosage that I just prescribed, complications of heparin therapy are rare.

Another complication to be considered—though it is rarely seen after operations for aneurysm—is “trash foot.” Usually it is associated with operations carried out for occlusive diseases. In repair of aneurysms, gelatinous clot in the sac may break off in large chunks, but the substance is relatively sticky and does not cause anywhere near the same embolic problem as seen in patients with occlusive disorders. To avoid this complication it is important to backfeed the iliac arteries before restoration of flow. When the aorta is particularly dilated and filled with lots of grumous material, careful attention should be given to removing it lest it cause peripheral embolization.

A PHYSICIAN: *Do you want to comment on ischemic damage to the colon?*

DR. WYLIE: Recognition of ischemic colitis may be very difficult. The initial damage is to the mucosa, and the outward appearance of the colon may be relatively good. The colon should be carefully examined and the pulses in the superior mesenteric artery palpated before the abdomen is closed. The patient is at greatest risk of ischemia of the colon in the presence of occlusive disease of the superior mesenteric artery or with hypogastric artery disease or in circumstances in which the hypogastric artery has not been revascularized at the time of aneurysm resection because of aneurysm degeneration. When aneurysms extend down into the common iliacs, we preserve the inferior mesenteric artery until the operation is completed. If we have not been able to revascularize at least one hypogastric artery and if there is any question about the adequacy of the collateral from the superior mesenteric artery, then the inferior mesenteric artery can be reimplanted in the graft. Rarely is this necessary, however; compromise of collateral circulation should not

occur, provided the critical collateral vessel is not destroyed by ligating the inferior mesenteric artery away from the wall of the aneurysm. If bloody mucus is passed by rectum in the post-operative period, ischemic damage to the colon must be considered. A further clue, on proctoscopic examination, is greyness of the mucosa. If there is any question, operation should be done and if the colon is at all ischemic to external appearance, large bowel resection and colostomy should be carried out.

FRANK LEWIS, MD:* *As a way of preventing this complication of rupture, could you give your criteria for operation on the “elective” aneurysm? If the aneurysm is asymptomatic, at what size do you think the hazard of rupture is sufficient to warrant operation?*

DR. WYLIE: In our series we have only had two cases of rupture of aneurysms smaller than 6 centimeters in diameter. For this reason, then, I believe that the arbitrary 6-centimeter rule is appropriate. Any asymptomatic aneurysm of less than 6 centimeters can probably be observed until it enlarges beyond that size or symptoms appear. However, if the patient is young and in good health, we might consider operation if the lesion is only 5 or 5.5 centimeters in diameter. Once the aneurysm exceeds 6 centimeters, if the patient's condition is optimal and life expectancy reasonably good, corrective operation can be carried out with expectation of less than 2 percent mortality.

F. WILLIAM BLAISDELL, MD:† We can summarize this presentation by stating that the risk of aneurysm operation in elective cases is 2 percent, but when the lesion ruptures it is 50 percent. When an aneurysm exceeds 6 centimeters, most vascular surgeons would advise elective resection.

Ruptured aneurysm can present in a number of different ways—rupture into the adjacent vena cava with immediate profound cardiac failure, rupture into the duodenum with massive gastrointestinal hemorrhage, and rupture into the psoas plane causing a mass in the groin. The typical manifestation, however, is abdominal and back pain often accompanied by transient shock due to rupture into the retroperitoneum which, if un-

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treated, is followed by a free rupture into the peritoneal cavity. When a patient presents with acute pain and a palpable mass, impending rupture should be assumed and the patient should be taken to the operating room without delay. If shock is present immediate operation is mandatory. The anesthesiologist should not wait for the presence of crossmatched blood. Control of the aorta can be obtained by going into the plane of periaortic blood dissection at the proximal end of the aneurysm if free hemorrhage is occurring, or simply by entering the aneurysm and putting a thumb into the aorta. If the neck of the aneurysm is so dilated that insertion of a thumb will not control bleeding, a Foley catheter can be used. Occasionally, crossclamping of the aorta at the level of the diaphragm is of value, and rarely it may be necessary to open the left side of the chest

to obtain control by clamping the descending thoracic aorta.

If the patient's condition is stabilized and he is not in shock at the time of laparotomy and no free bleeding is occurring, it is appropriate to obtain distal control before the hematoma is breached to obtain proximal control. A standard, knitted, dacron graft is used to replace the damaged section of aorta. Declamping shock should be avoided by careful, slow release of the circulation after the graft is in place, and the graft should be carefully wrapped with the residual wall of the aneurysm.

Complications of operation for ruptured aneurysm include renal failure, myocardial failure, ischemic damage to the colon and, rarely, peripheral embolism of atherosclerotic fragments or portions of a clot from the aneurysm.

Removing a Troublesome Contact Lens

HOW TO AVOID GETTING UP at 2 o'clock in the morning and going out to make a housecall on some patient to get a contact lens out?

It happened to me not too long ago . . . and of course, it was a doctor's daughter who had worn her contacts 15 hours that day and had only a tolerance of 11 or 12 hours. It was 2 a.m. I could hear her on the phone. She was about 17 or 18, but she was really carrying on . . . and the pharmacies don't deliver at that hour. I told this doctor to phone the pharmacy and have a taxicab bring out some Pontocaine® ointment. He said, "Oh, I can't get that in her eye." And I told him how to rub it on with his finger on the lashes and gently work it in until they could get the eye open . . . and then, when the ointment took hold and they could get the eye open, that he certainly could get the lens out with her little suction cup. Or, if he couldn't do that, at least he could take an eye cup and some warm water . . . and wash it out. This succeeded. I saw her the next morning and her comment was, "I never believed that I would be able to get to your office this morning!"

—GEORGE E. MORGAN, MD, *Los Angeles*
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